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REGIONAL COOPERATION

Project for a Europe-Africa permanent link through the Strait of Gibraltar

Note by the Secretary-General

1. The Secretary-General has the honour to transmit to the Economic and Social Council the report prepared in accordance with Council resolution 1995/48 by the Executive Secretaries of the Economic Commission for Europe and the Economic Commission for Africa on the work that has been done in connection with the project to establish a Europe-Africa permanent link through the Strait of Gibraltar.

2. The Economic and Social Council has taken an interest in this project since 1982 following a decision by the Governments of Morocco and Spain to carry out joint studies on the feasibility of the project as part of an agreement on bilateral cooperation adopted on 24 October 1980. Since then the Council has regularly requested the two regional commissions to keep track of the progress of studies relating to the project and to inform the Council of any developments.

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ANNEX

Project for a Europe-Africa permanent link through the Strait of Gibraltar: report on studies and activities carried out during the period 1995-1996

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INTRODUCTION

1. In its resolution 1995/48 of 27 July 1995, the Economic and Social Council requested the Executive Secretaries of the Economic Commission for Africa and the Economic Commission for Europe to take an active part in the follow-up to the project for a Europe-Africa permanent link through the Strait of Gibraltar and to report to the Council at its substantive session of 1997.

2. This report is a response to that request. It was drawn up jointly by the two regional commissions and gives a brief overview of the progress made following studies carried out up until 1996. It also takes account of other project-related activities organized further to Council resolution 1995/48 under the joint auspices of the two regional commissions and the International Tunnelling Association (ITA), a non-governmental organization in consultative status with the Council.

3. It should be recalled that studies designed to advance the project have been carried out jointly by the Governments of Morocco and Spain since 24 October 1980, the date on which the two Governments adopted a bilateral agreement on the subject. This agreement which was later expanded by a supplementary agreement of 27 September 1989, formally establishes both Governments' commitment to make a joint study of the feasibility of the project, stipulates the creation of a standing intergovernmental Joint Committee which was to be responsible for carrying out the agreement, and two State companies, one in Morocco and the other in Spain, which were to be responsible for conducting the studies. These companies, which have been working alongside the Joint Committee since 1981, are, on the Spanish side, Sociedad de Estudios para la Comunicación Fija a través del Estrecho de Gibraltar (SECEG), which has its head office in Madrid, and on the Moroccan side, Société Nationale d'Etudes du Détroit (SNED), whose head office is in Rabat. The studies are carried out either by the two research companies directly, or through scientific institutions from both countries or national or international firms of consultants and surveyors with whom the companies have concluded agreements or contracts for services.

4. Within the above-mentioned institutional framework, the studies are being carried out in phases and programmes of studies. The feasibility studies currently in progress are a follow-up to the pre-feasibility studies which were completed in 1990. The feasibility studies are being conducted in two stages, the first of which was completed in 1996. It should be pointed out that during the first stage of the feasibility studies the two regional commissions prepared an important evaluation report which they submitted to the Economic and Social Council at its substantive session of 1993 (E/1993/80). The important background data contained in this report were used as reference points for later studies in that first stage. Attention is also drawn to the report submitted to the Council at its substantive session of 1995 (E/1995/46).

5. The feasibility studies conducted during the first stage have made it possible to select a basic option for implementation of the permanent link project in order to continue the studies. The following two sections contain, respectively, a brief description of this option and a preliminary evaluation of

that option, together with indications regarding the main lines to be followed in the second stage of the feasibility studies.

I. BASIC OPTION ACCEPTED

6. Comparisons of the two types of solutions considered at the preliminary pilot project stage provided ample confirmation that the "tunnel" option was more realistic and advantageous, from the technical, economic and environmental standpoint, than the "bridge" option. This confirmation is based on the following factors:

(a) The extent of the technological developments which would still be required for the "bridge" option;

(b) The estimated construction cost for the "bridge" option is approximately four to six times higher overall than that of the "tunnel" option;

(c) Unlike the "bridge" option, the "tunnel" option lends itself to development in phases, which would make a significant difference in economic terms;

(d) Environmental criteria, particularly as regards interference with shipping through the strait, strongly favour the "tunnel" option.

7. The essential characteristics of the basic option accepted are as follows:

(a) The link would consist of a tunnel-type structure drilled under the sill of the strait;

(b) The operation would be a rail-ferry type of operation designed to carry both rail traffic in regular trains and road traffic, which would be carried on shuttle trains, between a Spanish terminal and a Moroccan terminal. The structure would consist of two parallel rail tunnels with a single track and a service tunnel situated midway between the two;

(c) Construction of the structure would follow the principle of first building the undersea portion of the service tunnel as a reconnaissance gallery (phase 0);

(d) Subsequently the work would be executed in two stages: the single-track stage (phase 1) which would involve construction of only one of the proposed rail tunnels - together with all elements necessary to put it into service, including the terminals and the underground sections of the service tunnel; and the two-track stage (phase 2) consisting essentially of adding the second rail tunnel as soon as the amount of traffic justified doing so;

(e) The rail and road connections with the Moroccan and Spanish networks and the relevant accessory facilities would be built by the respective administration, and part of the construction costs thereof would be charged to the project based on criteria of economic utility;

(f) As a preliminary evaluation, the basic option is also determined by the following characteristics:

(i) It was assumed that, during the single-track phase, the system would take some time to reach saturation point; accordingly, the preliminary economic analysis was limited, at this point in time, to this phase of the project;

(ii) The estimated construction and operating costs, estimates of traffic and toll revenue and assessment of the project's economic impact correspond to the baseline cases considered in the respective studies;

(iii) Estimates of the cost of connections and accessory facilities and how these would be divided, were based, at this stage on summary estimates;

(iv) The institutional arrangement accepted for the preliminary economic and financial analysis is one which would combine a private concessionaire and public funding, whereby the licensors - the administrations - would turn over the reconnaissance tunnel to the concessionaire free of charge and the latter would subsequently incorporate it into the project as a pilot tunnel and service tunnel; he would build the project and operate it at his own risk for the duration of the concession and hand the entire project back to the administrations when the concession lapsed.

II. PROVISIONAL EVALUATION OF THE BASIC OPTION

8. The basic option accepted for the permanent link in the Straits of Gibraltar prompts the following preliminary comments:

A. Technical aspects

9. The general concept of the basic option as a rail-ferry tunnel - that would take both regular trains and road traffic on rail shuttles - with two single-track one-way tunnels and a service tunnel situated midway between the two is considered appropriate.

10. The single-track phase of the basic option would require maintaining a high level of quality of service in the system, particularly when operations were approaching saturation point.

11. The maximum value adopted for the gradients/slopes of the structure (25:1,000) is unprecedented in large underwater railway tunnels. This will make it necessary to equip some heavy freight convoys with additional traction and to maintain an exceptionally high level of quality of operating systems which, added to the requirements in this respect mentioned above, could prompt a downward revision of the saturation capacity attributed to the single-track tunnel.

12. At the current stage of geological and geotechnical knowledge of the site, there are favourable prospects for the technical feasibility of the proposed tunnels at an acceptable level of assurance, this being understood in the context of the practical needs for detailed information and the practical difficulties of meeting those needs through off-shore surveying. In this context, the following research needs to be carried out - it is, in fact, envisaged in the companies' work plan - insofar as technically viable:

(a) Determination, by means of appropriate mechanical and/or geophysical surveys, of the thickness of the recent Quaternary formations covering the deepest areas of the sill of the strait;

(b) Completion of a deep drilling survey, which was not done in 1995.

13. Within the geological-geotechnical framework provided by the studies of the physical environment, the technical feasibility of the structure was established in the preliminary pilot project for the basic option with a high level of reliability. Certain technical problems will have to be investigated further, however; these problems relate mainly to the choice of the most appropriate type of tunnel boring machine in relation to the geomechanical characteristics of the ground formations, and the choice of certain specialized techniques relating to, inter alia, monitoring of progress, possible treatment of problematic ground formations and protection against possible leaks of water and gas. In this respect, it is considered necessary, as in fact envisaged by the companies, to make a detailed study of these problems in the near future through:

(a) Studies, in the context of the detailed pilot project, of the underwater section of the service tunnel, taking into account the latest results obtained from geotechnical experimentation structures;

(b) Detailed technical follow-up of similar structures currently under construction which are of interest to the project and, in general, engineering studies which have been envisaged.

B. Project costs

14. The project costs which have been used for this provisional evaluation are derived, as regards the permanent link structure as such, from the preliminary pilot project for the basic option. These costs, which have been established by analytical methods for construction operations, show in principle a reasonably stable sensitivity to the likely variations of the main external factors. As to their reliability, the tests made in this respect tend to support the conclusion that the costs have been estimated in the context of the basic pilot project with conservative margins which will need to be refined later, since the width of these margins is currently difficult to specify.

15. For reasons associated with the proper management of the study process, accentuated by the importance of taking into account construction costs when determining the economic feasibility of the project, it is felt necessary to continue the efforts to analyse cost sensitivity and reliability, both in conjunction with the activities for the monitoring of related structures,

referred to above, and through alternative cost engineering approaches or methods involving consultation with experts.

16. Since the cost of the connecting and accessory structures associated with the project is very high, it is essential to refine the estimates of these costs and how they would be divided and, perhaps, show how these structures would fit in with the relevant master plans of each country.

C. Traffic projections

17. The models used for traffic projections seem to be technically well suited to estimating the amount of traffic diverted and engendered. However, the process of improvement which is under way, must be accelerated particularly along the lines envisaged, so as to:

(a) Recalibrate the models, statistically and structurally, on the base year 1995, in a similar manner to the last recalibration;

(b) Increase the specificity of models in the area which would be heavily influenced by the project and in the strait area through the elaboration of a "zoom" model, with a view to modelling trade patterns and traffic routing in greater detail.

18. The methods used for projecting the traffic created, although technically excellent, probably underestimate the potential volume of local traffic created by the permanent link, associated measures and, possibly, voluntary policies for the development of the strait region. Consequently, a new approach needs to be developed, in conjunction with or in the context of the regional impact study envisaged, in order to take these effects more fully into account.

19. In the baseline case of the permanent link, the sensitivity of traffic projections is low in relation to the likely trends in the evolution of costs and transport times in the various modes operating in the area affected by the project. The sensitivity is more pronounced in relation to variations in external factors such as a variation in the economic growth scenario or a decline in ferry fares across the strait.

20. At the beginning of the current decade, economic growth proved to be lower than projected in the baseline economic growth scenario, which was drawn up in the light of the trends observed during the period 1980-1990 and on which the traffic projections are based. After 1994, however, there was an upturn and, according to the competent institutions, economic growth is expected soon to match - and in some regions of the area covered by the models, possibly surpass - the baseline scenario until at least 1998.

21. The traffic models have been tested against the recent past (1990-1994) with numerically satisfactory results, especially as regards the response of the models taking into account observed economic growth ("ex post" test). These tests, however, have a limited value because of the limitations of the models - which are designed for the long term - in providing accurate short-term

projections and because of the quality of the statistical data on observed traffic.

22. One of the best pilot indicators of the reliability of medium/long-term traffic projections is probably the rate of traffic increase observed for the strait corridor without a permanent link, because the projection models are based on the assumption of an increase in this traffic from the baseline year (1990). The test on total passenger traffic, theoretically the most direct, has been found to be of little value because of statistical shortcomings; however, the test on vehicular traffic - and therefore, indirectly, on automobile passenger traffic - has confirmed the projections. Naturally the result of this test must be viewed with reservations because of its indirect nature - it relates to only one category, albeit very indicative, of traffic - and because of the quality of the statistics used.

23. Although the companies have developed a fairly detailed socio-economic and traffic database, derived mainly from the collection of secondary data, there is an urgent need at the current stage of studies to undertake, inter alia, an internal evaluation of the consistency of the data and, above all, to acquire information directly through surveys and taking counts on the most significant flows.

D. Economic viability of the basic option

24. On the basis of the cost and traffic projections associated with the basic option, an economic analysis of the project has been undertaken, on a provisional basis, by the method of evaluating the variation in the collective utility of the project, measured through the surpluses derived by the economic agents involved in the project area and, specifically, the following: (a) the managing body of the project; (b) the transport enterprises affected - air, maritime and rail transport; (c) the project users; and (d) the public administrations. The result obtained for the baseline case from this preliminary evaluation, which was carried out within the overall context of the project, corresponds to an internal rate of return of about 15 per cent, and this figure is relatively sensitive to variations in cost and traffic projections for the permanent link. This result, which is relatively favourable in numerical terms, must be judged, however, in the light of this sensitivity, taking into account also the following considerations:

(a) This rate refers to the project surplus generated over the totality of the vast area of study considered in the traffic models, and not a particular economic-fiscal system, as is normal in the practice of evaluating infrastructure projects. In this respect, the rate which has been calculated relates to all the 'intrinsic' advantages of the project and, consequently, it is a theoretical internal rate, which is comprehensive in nature;

(b) Since there are no plans, at this stage in the evaluation process, to evaluate the profitability of the project in relation to a particular economic system - for example, Spain-Morocco, or this combination with the participation of the European Union and the Arab Maghreb Union - it must be assumed that the 'actual' internal rate of return, in relation to a particular economic area

bearing the costs of the project, will be several points lower than the theoretical rate;

(c) It should also be noted that the internal rate of return which has been calculated tends to be conservative, in that it does not take into account all the economic advantages attributable to the project, such as certain effects resulting from savings made, particularly in the strait region itself, whose trend-driven and, possibly, voluntary structural effects are potentially significant.

E. Financial viability of the basic option

25. The preliminary evaluation of the "purely" financial viability of the basic option is probably too low (internal rate of return of about 10 per cent) and too sensitive to uncertainties concerning variations in cost and traffic figures, to make it possible, at least at this stage of the study process, to envisage having the project financed entirely by the private sector.

26. In order to consider the possibilities of setting up the project on the basis of a scheme which would combine private and public funding, with sufficient public funds to make the project financially attractive to the private sector, a provisional evaluation of the basic option has been made in the following context:

(a) Under the proposed scheme, the licensor would hand over to the concessionaire, free of charge, a part of the structure consisting of the underwater section of the service tunnel, previously constructed by the licensor as a reconnaissance gallery. It should be noted that this assumption - based in any case on the advantages which, in the technical and economic context of the project, it offers, in principle, over other financially equivalent joint financing options - is simply a working hypothesis for the provisional evaluation which has been carried out;

(b) The project would be constructed by a concessionaire of the licensing administrations under a conventional concessional regime (build-operate-transfer) (BOT); the term of the concession would be 40 years and the percentage of capital initially provided by the concessionaire would be equivalent to 20 per cent of the total cost of the structure.

27. In these circumstances, the financial returns on the concessionaire's capital, measured by the internal rate of return of capital disbursement flows and distributed dividends, converted into constant prices, would be about 13.5 per cent. It should be noted that the sensitivity of this indicator to cost and traffic variations is significantly greater than in the case of the economic analysis and, as before, the value remains subject to the reservations inherent in the cost and traffic estimates relating to the basic option.

III. FUTURE DEVELOPMENTS

28. The project to establish a permanent link through the Strait of Gibraltar passed an important milestone in its development when, at the end of stage 1 of the feasibility phase, a basic option for the continuation of the studies was selected from among the possible structural options. These studies have now entered stage 2 of the feasibility phase, on the basis of a detailed programme of work drawn up by the Société Nationale d'Etudes du Détroit and the Sociedad de Estudios para la Communicación Fija a través del Estrecho de Gibraltar. The objective of this second stage is essentially to produce the feasibility study for the permanent link project, for the basic option which has been selected. To that end, two fundamental tasks will need to be carried out during the second stage, namely, the deep drilling survey, so as to gain more information about the subsoil of the deep areas of the strait, and additional studies, at the level of the detailed preliminary project, of the reconnaissance gallery envisaged in the basic option.

IV. OTHER ACTIVITIES CARRIED OUT WITHIN THE CONTEXT OF THE PROJECT

Workshop on characterization of tunnel boring machines for tunnelling flyschs (Tarifa, 20 and 21 February 1997)

29. Because of the international dimension of the permanent link project, from the viewpoint of both its economic effects and its technical uniqueness, the study process, in addition to follow-up from the outset by the Economic and Social Council through the Economic Commission for Europe and the Economic Commission for Africa, has featured a number of symposia - four altogether have been organized so far - and other international meetings devoted to consideration of different aspects of the project.

30. Since the time of the last report (E/1995/46), which was submitted to the Economic and Social Council in 1995, and following Council resolution 1995/48, a workshop of characterization of tunnel boring machines for tunnelling flyschs was held at Tarifa (Spain) on 20 and 21 February 1997, under the joint auspices of the two regional commissions and the International Tunnelling Association (ITA). The workshop, in which 40 international experts participated, demonstrated, inter alia, that among the different methods of tunnelling that are possible, the tunnel boring machine is best suited to a tunnel under the strait.

31. Another workshop, on the methodology for establishing the costs of the construction of tunnels bored with tunnel boring machines, was held at Vienna on 11 April 1997 on the occasion of the 1997 world congress of the International Tunnelling Association.